CLAIMS

1. A regenerative amplifier system, comprising:

a pump source that produces a pump beam;

first and second mirrors that define a resonant cavity

a gain medium positioned in the resonant cavity and optically coupled to the pump source;

an oscillator that produces multiple seed pulses;

a first electro-optic switch positioned external to the cavity, the first electro-optic switch configured to provide selection of a single seed pulse for the cavity and directs an amplified pulse produced in the cavity in a direction away from the oscillator, and

a second electro-optic switch positioned in the cavity that switches the seed pulse in and out of the cavity.

2. The system of claim 1, wherein the first and second electro-optic switches are Pockels cells.

3. The system of claim 1, wherein the gain media is selected from Yb:KGW, Yb:KYW, Yb:YAG, Yb:SYS, Yb:BOYS, Yb:GdCOB, Yb:glass, Nd:KGW, Nd:glass, Cr:LiSAF, Cr:LiCAF, Ti:sapphire, Nd:YAG, Nd:YLF and Nd:YVO_4.

4. The system of claim 1, wherein the gain media is Yb:KGW.

5. The system of claim 1, wherein the pump beam has a power in the range of 1-100 W.

6. The system of claim 1, wherein the pump beam has a power in the range of 1-30 W.

7. The system of claim 1, wherein the pump beam has a power in the range of 1-10 W.

8. The system of claim 1, wherein the pump beam has a wavelength in the range of 800 to 1000 nm.

9. The system of claim 1, wherein the seed pulse has a duration in the range of about 100 fs.

10. The system of claim 1, wherein the seed pulse has a duration in the range of about 300 fs.

11. The system of claim 1, wherein the seed pulse has a duration in the range of about 1ps.

12. The system of claim 1, wherein the stretched seed pulse has a duration in the range of about 100 ps.

13. The system of claim 1, wherein the stretched seed pulse has a duration in the range of about 300 ps.

14. The system of claim 1, wherein the stretched seed pulse has a duration in the range of about 1ns.

15. The system of claim 1, wherein the full power of the seed pulse can be switched in to the cavity.

16. The system of claim 1, wherein the undesired seed pulses do not pass through the gain medium.

17. The system of claim 1, wherein the pump source is selected from a diode, a diode bar, a fiber-coupled diode bar, and a single fiber-coupled diode bar.

18. The system of claim 1, wherein the pump source is a single fiber-coupled diode source.

19. A method for producing an amplified pulse from a regenerative amplifier system, comprising:

producing a pump beam from a pump source;

producing multiple seed pulses from the oscillator;

selecting a single seed pulse for the cavity; and

excluding the undesired seed pulses from the cavity, and

switching the seed pulse in and out of the cavity; and

directing an amplified pulse produced in the cavity in a direction away from the oscillator.

20. The method of claim 19, wherein the regenerative amplifier system includes a cavity, gain medium, first and second electro-optic switches and an oscillator.

21. The method of claim 19, wherein selecting the single seed pulse for the cavity improves a contrast ratio of the amplified pulse to a pre-pulse.

22. The method of claim 19, wherein the first electro-optic switch is positioned external to the cavity, and the second electro-optic switch is positioned in the cavity.

23. The method of claim 22, wherein the first electro-optic switch selects the single seed pulse for the cavity.

24. The method of claim 22, wherein the second electro-optic switch switches the seed pulse in and out of the cavity.

25. The method of claim 22, wherein the first electro-optic switch directs the amplified pulse produced in the cavity in a direction away from the oscillator.

26. A method for producing an amplified pulse, comprising:

providing a regenerative amplifier system that includes a cavity, gain medium, an electro-optic switch for switching a pulse in to and out of the amplifier and an oscillator;

producing a pump beam from a pump source;

producing multiple seed pulses from the oscillator;

generating a high voltage pulse with on and off voltage edges to drive the electro-optic switch; and

synchronizing the on and off voltage edges applied to the electro-optic switch by counting pulses from the oscillator.

27. The method of claim 26, wherein synchronizing the on and off voltage edges applied to the electro-optic switch reduces jitter in the voltage edges.

28. The method of claim 26, wherein synchronizing the on and off voltage edges applied to the electro-optic switch increases the pre-pulse contrast ratio.

29. The method of claim 26, wherein synchronizing the on and off voltage edges applied to the electro-optic switch increases the post-pulse contrast ratio